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**Christner et al.**

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(54) **BASS REFLEX LOUDSPEAKER SYSTEM WITH PHASE CORRECTION ELEMENT**

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(51) **Int. Cl.**

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| ***H04R 1/28*** | (2006.01) |
| ***H04R 1/34*** | (2006.01) |

(52) **U.S. Cl.**

CPC ..... ***H04R 1/2819*** (2013.01); ***H04R 1/2815*** (2013.01); ***H04R 1/2826*** (2013.01); ***H04R 1/347*** (2013.01); *H04R 2201/029* (2013.01); *H04R 2201/34* (2013.01)

(58) **Field of Classification Search**

CPC ..... H04R 1/28; H04R 1/30; H04R 1/34; H04R 1/345; H04R 1/2803; H04R 1/2815; H04R 1/2819; H04R 1/2834; H04R 1/2842; H04R 1/2869; H04R 1/347; H04R 5/033; H04R 2201/029; H04R 2201/34

USPC ..... 381/338, 339, 340, 342, 343, 345, 349, 381/350, 351, 370, 371, 374, 182, 186; 181/152, 155, 156, 159, 185, 199

See application file for complete search history.

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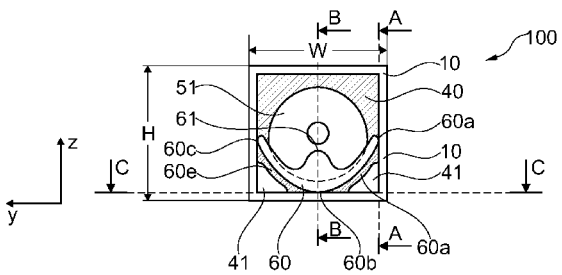
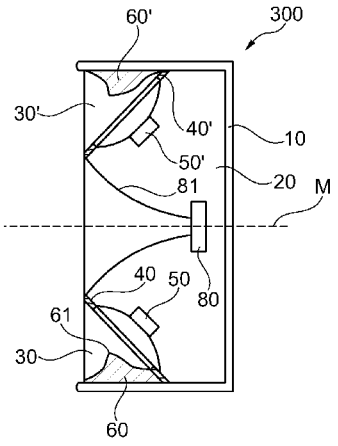
(57) **ABSTRACT**

A loudspeaker system has a loudspeaker housing that comprises at least a first and a second housing chamber. The loudspeaker system has a bass loudspeaker that is mounted on a partition between the first housing chamber and the second housing chamber, wherein the back of the bass loudspeaker has the first housing chamber present and the front of the bass loudspeaker has the second housing chamber present. The partition contains at least one bass reflex opening. A phase correction element is arranged at the front of the bass loudspeaker in the second housing chamber. The bass reflex opening opens into the second housing chamber and is arranged in a region adjacent to the phase correction element.

**19 Claims, 4 Drawing Sheets**



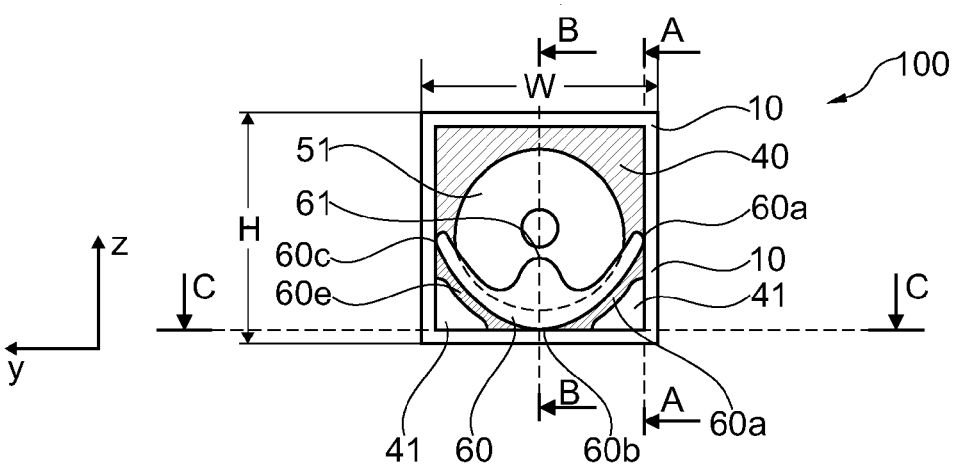



Fig. 1

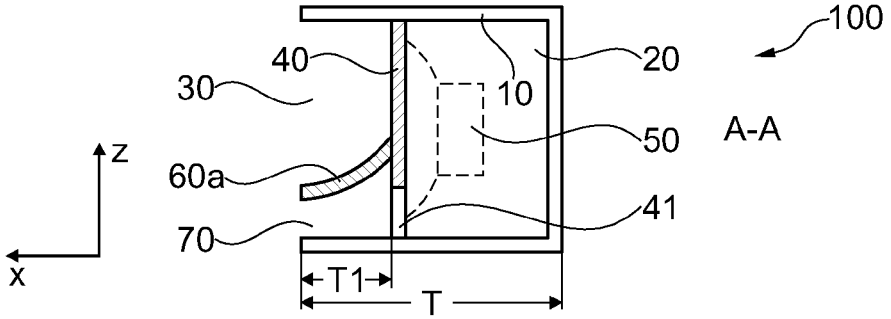



Fig. 2

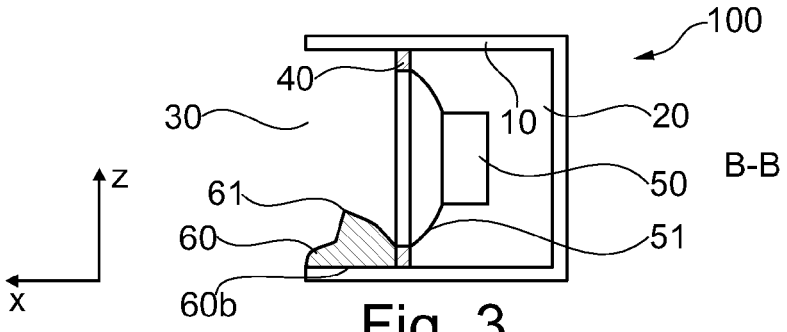



Fig. 3

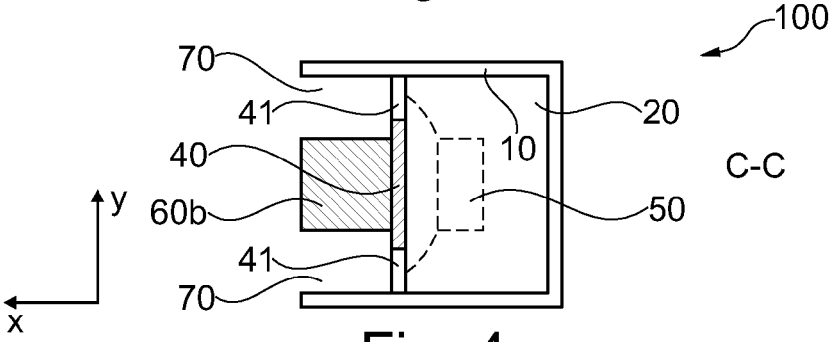



Fig. 4

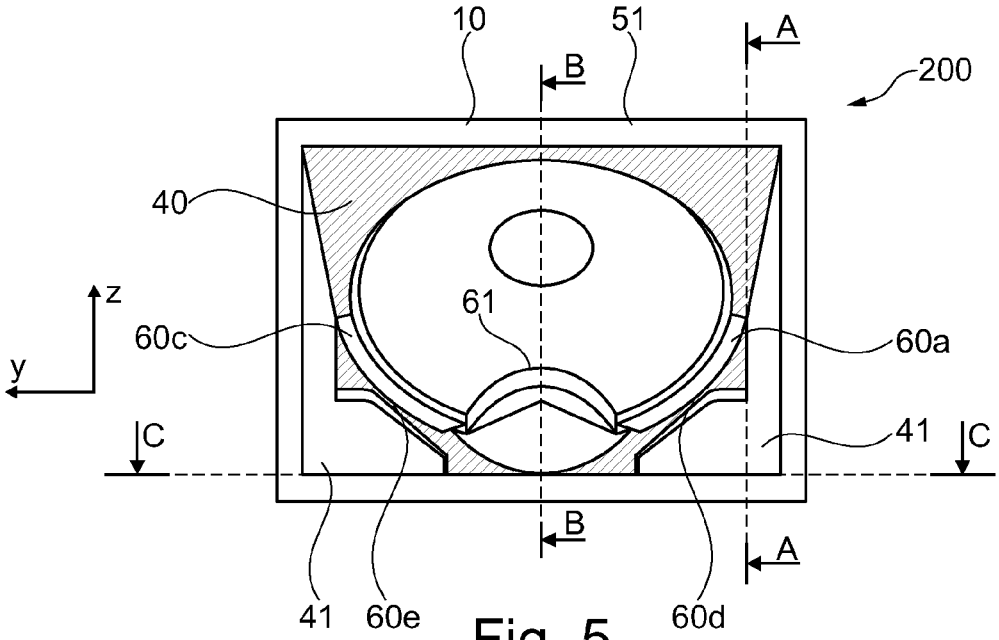



Fig. 5

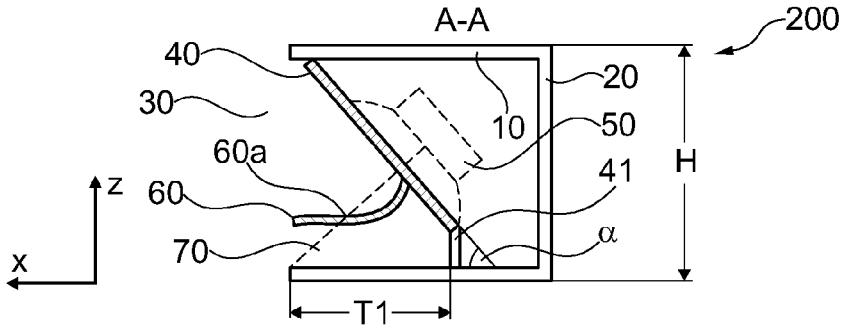



Fig. 6

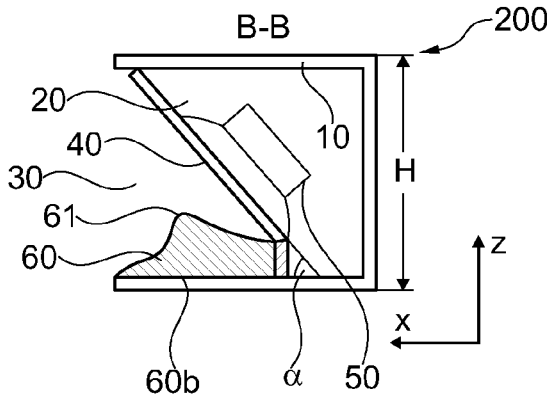



Fig. 7

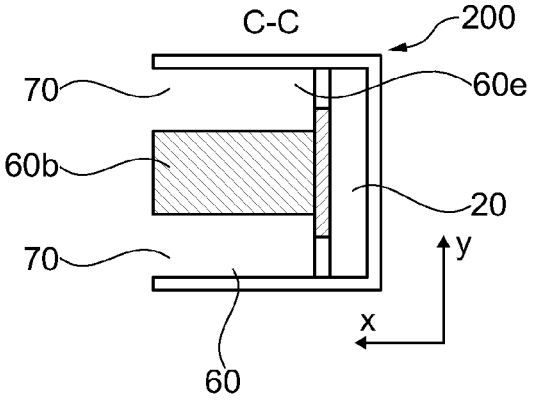



Fig. 8

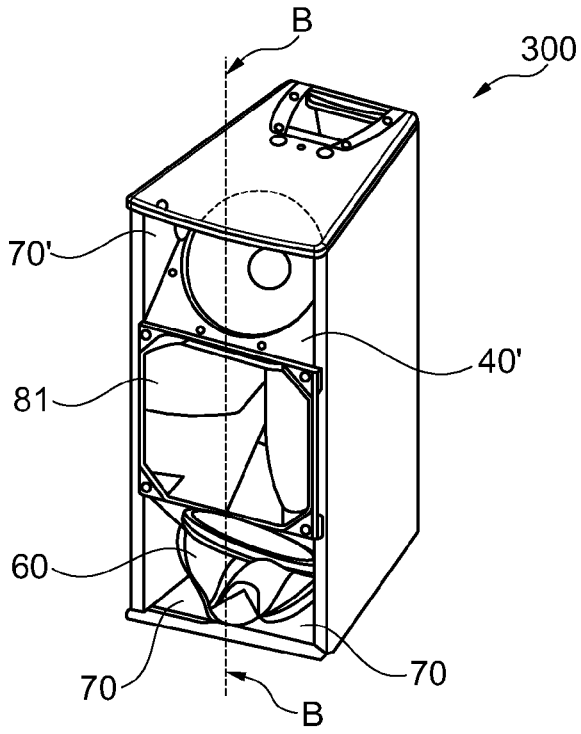



Fig. 9

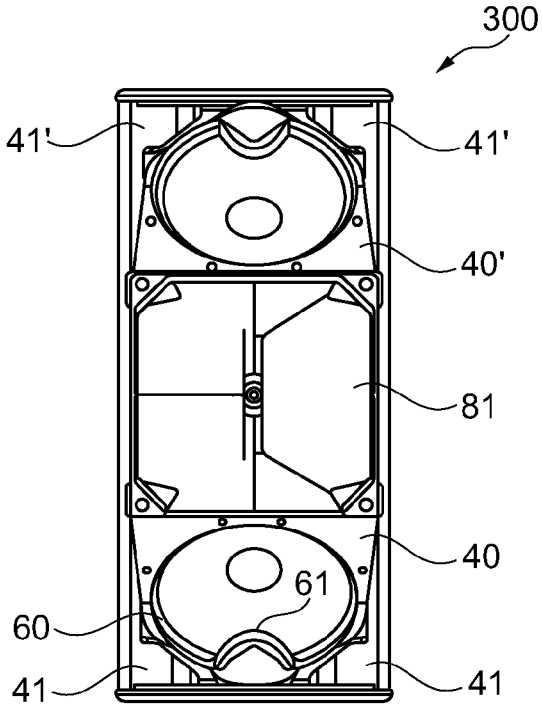



Fig. 10

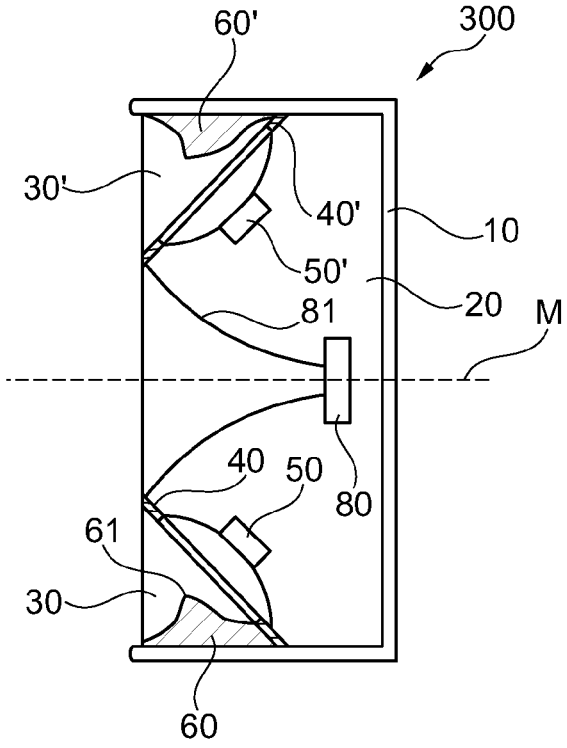



Fig. 11

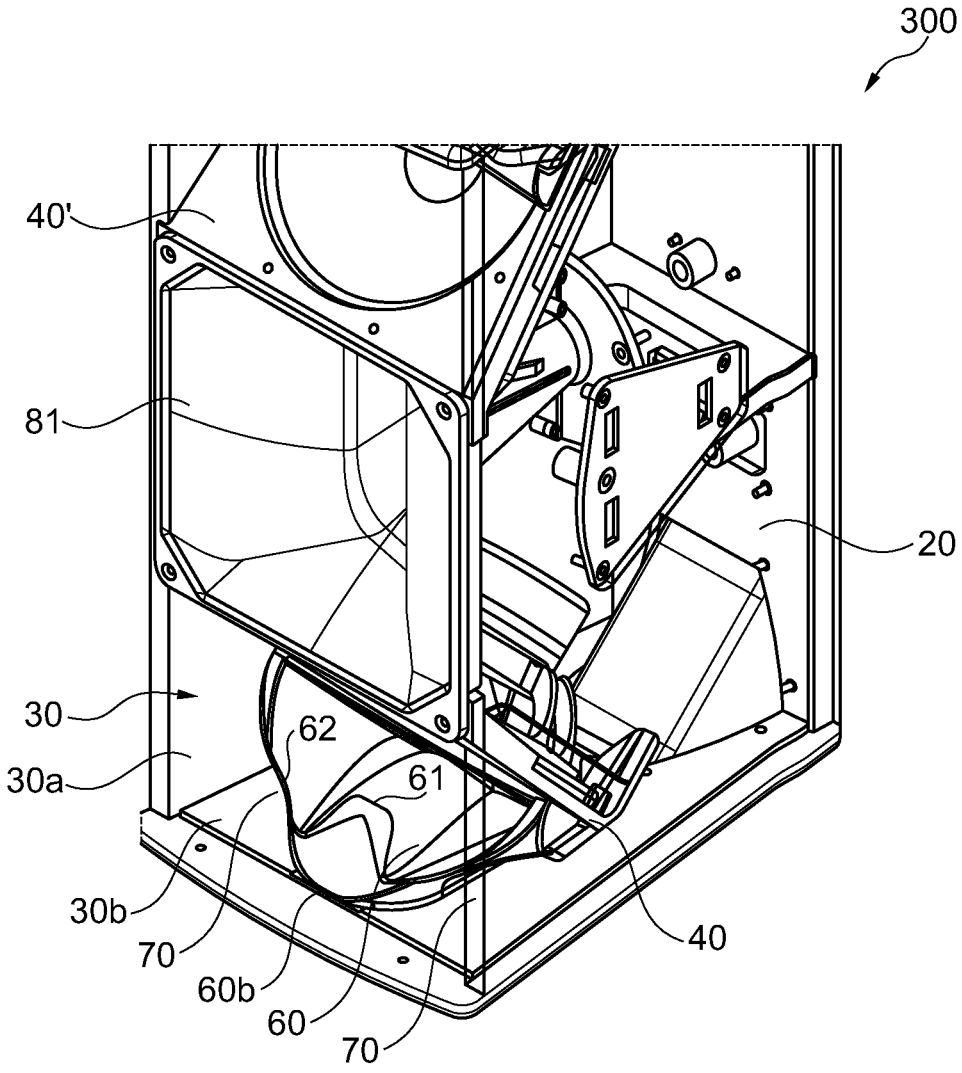



Fig. 12

# BASS REFLEX LOUDSPEAKER SYSTEM WITH PHASE CORRECTION ELEMENT

## RELATED APPLICATIONS

This application claims priority to German Patent Application 10 2013 110 535.1, filed on Sep. 24, 2013, which is incorporated herein by reference.

## TECHNICAL FIELD

The disclosure relates to a bass reflex loudspeaker system with a phase correction element.

## BACKGROUND

Bass reflex loudspeaker systems are frequently used in sound engineering. In bass reflex loudspeaker systems, the loudspeaker housing is not closed, but rather provided with a channel leading to the outside. The term ventilated or vented systems is also used. The sound component radiated backwards from the loudspeaker is used in order to increase the efficiency of the loudspeaker system in the region of the resonant frequency of the loudspeaker system. It is possible to achieve significantly increased sound pressure levels and an extension of the power bandwidth.

## SUMMERY

An object of various embodiments can be considered to be that of providing a loudspeaker system having good sound properties, small physical size and/or a high sound pressure level.

The loudspeaker system may comprise a loudspeaker housing that has at least a first and a second housing chamber. A bass loudspeaker is mounted on a partition (partition board) between the first housing chamber and the second housing chamber, wherein the sound at the back of the bass loudspeaker is radiated into the first housing chamber and the sound at the front of the bass loudspeaker is radiated into the second housing chamber.

Further, a loudspeaker system having a loudspeaker, a first housing chamber into which the bass loudspeaker radiates at the back and that forms a first resonator, a second housing chamber into which the bass loudspeaker radiates at the front and that forms a second resonator, a bass reflex resonator that interacts with the first resonator, and a phase correction element, which is accommodated in the second housing chamber, for decreasing the mode acuity of the second resonator is disclosed. At least one portion of the bass reflex resonator may, e.g., be arranged in the second housing chamber adjacent to the phase correction element.

## BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the disclosure are explained below using exemplary embodiments with reference to the drawings, in which:

FIG. **1** is a schematic front view of an exemplary loudspeaker system;

FIG. **2** is a sectional view of the loudspeaker system shown in FIG. **1** along the sectional line A-A;

FIG. **3** is a sectional view of the loudspeaker system shown in FIG. **1** along the sectional line B-B;

FIG. **4** is a sectional view of the loudspeaker system shown in FIG. **1** along the sectional line C-C;



FIG. **5** is a perspective front view of an exemplary loudspeaker system with an obliquely running partition;

FIG. **6** is a sectional view of the loudspeaker system shown in FIG. **5** along the sectional line A-A;

FIG. **7** is a sectional view of the loudspeaker system shown in FIG. **5** along the sectional line B-B;

FIG. **8** is a sectional view of the loudspeaker system shown in FIG. **5** along the sectional line C-C;

FIG. **9** is a perspective view of an exemplary loudspeaker system with two bass loudspeakers;

FIG. **10** is a front view of the loudspeaker system shown in FIG. **9**;

FIG. **11** is a sectional view of the loudspeaker system shown in FIG. **9** along the sectional line B-B; and

FIG. **12** is a perspective detail view of a region of FIG. **9**.

In the appended drawings, the same or similar parts are denoted by the same reference symbols. The dimensions shown in the Figures may be but are not necessarily to scale. The disclosure content of the drawings is therefore intended to entail both a specific, to-scale understanding of these Figures and a more general, not-to-scale understanding of the Figures in the sense of schematic illustrations. In addition, housing walls (e.g. bottom wall and top wall, side walls) that are shown parallel to one another in the Figures may be oriented parallel to one another, but in general it is also possible to have such walls in orientations inclined toward one another.

Features that are explained with reference to different embodiments can be combined with one another if they are not alternative features. By way of example, that is to say that elements explained with reference to one of the embodiments, for example the phase correction element and the various housing chambers and resonators, and also the properties thereof may also apply to the corresponding elements and the properties thereof in another embodiment.

## DETAILED DESCRIPTION

It is to be understood that the features of the various exemplary embodiments described herein may be combined with each other, unless specifically noted otherwise.

The loudspeaker system described herein may have at least one bass reflex opening in the partition and a phase correction element that is arranged at the front of the bass loudspeaker in the second housing chamber. In this case, the bass reflex opening may open into the second housing chamber and may be arranged in a region adjacent to the phase correction element.

This adjacent physical arrangement of the phase correction element and the bass reflex opening may allow a space-saving design. A bass reflex channel (or duct) adjoining the bass reflex opening can have at least sections running in the second housing chamber and can be displaced therein into an otherwise "dead" volume, for example, in a region adjacent to the phase correction element, for example bounded by the back of the phase correction element. A loss of volume in the first housing chamber as the result of a bass reflex channel that, according to conventional design, projects into the first housing chamber can therefore be avoided or at least reduced.

This additionally usable volume in the first housing chamber may make the resonator formed by the first housing chamber more efficient, which results in a sound pressure level increase at its resonant frequency. At the same time or alternatively, a reduction in the physical size of the first housing chamber and hence of the entire loudspeaker housing in comparison with the conventional design with a bass reflex chan-

nel fully present in the first housing chamber can be achieved for a prescribed maximum sound pressure level.

The phase correction element, for example what is known as a phase plug, may have a flat, curved or else wing-shaped form. The form of the phase correction element produces a volume geometry in the second housing chamber that suppresses any undesirable higher resonance mode as far as possible, but in so doing impairs the desired fundamental resonance of the second housing chamber as little as possible. Above the fundamental resonance, the phase correction element thus prompts mode extension or a decrease in mode quality. The phase correction element attenuates or eliminates discrete or acute modes of the resonator, which impair the sound, at the front of the bass loudspeaker.

The phase correction element can extend radially outward from a central region—with reference to the direction of radiation—of the loudspeaker on both sides. By way of example, it can extend in the radial direction beyond the loudspeaker edge and possibly at least in sections as far as the edge of the loudspeaker housing.

The bass reflex opening provided in the partition may be formed in the region of a corner of the first housing chamber or of the loudspeaker housing. This makes it possible to obtain a space-saving design with a comparatively small physical size.

In addition, provision may be made for a wall section of the phase correction element to form a wall region of a bass reflex channel containing the bass reflex opening. This design allows a saving on material, since separate ducts or the like, as are conventionally used for a bass reflex channel, can be dispensed with at least in the region of the phase correction element.

In addition, a wall region of a bass reflex channel containing the bass reflex opening may be formed by at least one wall section of the second housing chamber, particularly by two mutually perpendicular wall sections of the second housing chamber. This measure likewise allows the achievement of a saving on material in the sense described above (use of the wall sections as a wall region of a bass reflex channel).

A bass reflex channel comprising the bass reflex opening can extend over less than 50% of its length, particularly over less than 30% of its length—and possibly not at all—into the first housing chamber. The use of a partial volume of the second housing chamber for the bass reflex channel allows the latter to be accommodated predominantly or possibly completely in the second housing chamber. This measure increases the effective volume of the first housing chamber, which acts as a resonator volume. The housing size can therefore be decreased for a desired maximum sound pressure level or the maximum achievable sound pressure level can be increased for a prescribed housing size.

A bass reflex channel containing the bass reflex opening may have a sound exit opening that is situated between at least one housing wall of the second housing chamber and a contour line of the phase correction element. Hence, the (otherwise "dead") volume on the outside or back of the phase correction element can be used as a resonator volume for the bass reflex channel.

The sound exit opening of the bass reflex channel may be situated in a corner region of the second housing chamber. In this case, the volume in the corner region of the second housing chamber can be used as a resonator volume for the bass reflex channel.

A further possible variant embodiment involves the partition running at an inclination with respect to a back housing wall. This measure allows the physical height of the loudspeaker housing to be reduced further on account of the oblique installation position of the bass loudspeaker.

With an inclined partition, provision may be made for a bass reflex channel containing the bass reflex opening to extend at least from the rear end of the partition to the front end of the partition. That is to say that that section in the second housing chamber that is defined by the oblique position of the partition can be used to increase the volume of the bass reflex channel.

The loudspeaker system described herein may further comprise a further bass loudspeaker that is mounted on a further partition between the first housing chamber and the second housing chamber or a third housing chamber of the loudspeaker housing, wherein the back of the further bass loudspeaker has the first housing chamber present and the front of the further bass loudspeaker has the second or third housing chamber present. At least one further bass reflex opening may be present in the further partition. In addition, a further phase correction element may be present that is arranged at the front of the further bass loudspeaker in the second or third housing chamber. The further bass reflex opening can open into the second or third housing chamber and be arranged in a region adjacent to the further phase correction element.

Both the partition and the further partition can each run at an inclination with respect to a back housing wall. The effect that can be achieved by this is that there is a shorter distance between the two bass loudspeakers or the focus of radiation thereof. This reduces the height of the loudspeaker housing and promotes the physical radiation response toward high frequencies of the bass loudspeakers.

The loudspeaker system may further comprise a horn loudspeaker. The horn loudspeaker may be arranged between the bass loudspeaker and the further bass loudspeaker.

A sound exit opening of the bass reflex resonator may be arranged between a contour line of the phase correction element and a wall of the second housing chamber, particularly in a corner region of the second housing chamber. In addition, more than 50%, for example more than 80% and particularly 100%, of the air volume of the bass reflex resonator may be situated in the second housing chamber. These measures make it possible to attain a space-saving design and/or a high maximum sound pressure level for a given housing size, as already described.

FIGS. **1** to **4** schematically show an exemplary embodiment of a loudspeaker system **100** in various illustrations. The loudspeaker system **100** has a loudspeaker housing **10** that forms a first housing chamber **20** and a second housing chamber **30**. A bass loudspeaker **50** is mounted on a partition **40** that separates the first housing chamber **20** from the second housing chamber **30**.

By way of example, the loudspeaker housing **10** may have a width W in the y direction, a height H in the z direction and a depth T in the x direction. W, H and T may each be larger than 20 cm, 40 cm, 60 cm, 80 cm, 100 cm, with W, H and T being able to assume different values. As FIG. **1** shows, the loudspeaker housing **10** may have a rectangular cross section in front view. As FIGS. **2** and **3** show, the loudspeaker housing **10** may have a rectangular cross section, for example, in the x-z plane. According to FIG. **4**, the cross section of the loudspeaker housing **10** in the x-y plane may also be rectangular, for example, and tapering housing shapes in the −x direction, i.e. in the opposite direction to the main direction of radiation x, are also possible.

The bass loudspeaker **50** radiates its front sound into the second housing chamber **30** and its backward sound into the first housing chamber **20**. The first housing chamber **20** may

contain—not shown—further chambers and/or further loudspeakers, see also FIGS. **9** to **12**.

The first housing chamber **20** is connected to the second housing chamber **30** via at least one opening **41**. The opening **41** is subsequently referred to as a bass reflex opening. In the embodiment of the loudspeaker system **100** that is shown here, the partition **40** contains a plurality of, for example, two bass reflex openings **41**.

The one or more bass reflex opening(s) **41** may be situated in corner regions of the loudspeaker housing **10**, for example. The bass reflex openings **41** may be in the form of corner cutouts in the partition **40**. In this case, the bass reflex openings **41** are bounded by wall sections of the loudspeaker housing **10** that adjoin the corners and by an edge of the respective cutout in the partition **40**.

The bass reflex openings **41** may have an approximately triangular shape, as can be seen in FIG. **1** and also in FIG. **5**, for example. This form allows a large opening area to be achieved for simultaneously relatively small housing dimensions. Other shapes, e.g. a circular shape, are likewise possible.

Situated in the main direction of radiation x in front of the bass loudspeaker **50** is a phase correction element (phase plug) **60**. The phase correction element **60** may have a flat-curved, wing-shaped or spade-shaped form. By way of example, as can be seen in FIGS. **1** to **4**, it may have a basin-shaped form with raised edges with respect to the y dimension. Provided in the middle region of the phase correction element **60**, there may be a boss **61** that protrudes into the second housing chamber **30** in the z direction.

One or more side wall region(s) **60***a*, **60***c* and/or a bottom wall region **60***b* of the phase correction element **60** may be in contact with housing walls of the second housing chamber **30** or otherwise connected to the latter and may form an airtight closure with said housing walls, for example. The outer wall sections **60***d*, **60***e* of the phase correction element **60**, which lie between the side wall regions **60***a*, **60***b*, **60***c* of the phase correction element **60** that close the housing walls, can form a wall region of a bass reflex channel (duct) **70** containing the bass reflex openings **41** in the X direction.

This means that the bass reflex channel **70** can be formed in the region of the second housing chamber **30** by wall areas of the second housing chamber **30** and/or by outer wall sections **60***d*, **60***e* of the phase correction element **60**. It is possible for the bass reflex channel **70** in the second housing chamber **30** to be formed exclusively by housing wall areas and outer wall sections **60***d*, **60***e* of the phase correction element. In this case, it is not necessary for additional elements such as ducts or the like to be connected to the bass reflex openings **41** in the x direction in order to form a bass reflex channel. That is to say that the use of already present wall areas of the second housing chamber **30** and/or outer wall sections **60***d*, **60***e* of the phase correction element that are present can achieve a saving on material for the requisite production of the bass reflex channel **70**.

However, it is also possible for the bass reflex channel **70** in the region of the second housing chamber **30** to be produced—not shown—by a length of duct that adjoins the bass reflex opening **41** and runs in the x direction. Such a length of duct (not shown) can extend in the x direction between the outer wall section **60***d* or **60***e* of the phase correction element **60** and the wall regions of the second housing chamber **30** that are close to the corners. The length of duct may have essentially the same cross-sectional opening as the bass reflex opening **41**, i.e. may exhibit a triangular form in the broadest sense or else a circular-disk form, for example.

At least some portion of the bass reflex channel **70** can run within the second housing chamber **30** and be arranged there adjacent to the phase correction element **60**. By way of example, the peripheral contour of the bass reflex channel **70** may match the contour of an outer wall section **60***d* or **60***e* of the phase correction element **60** or can have at least sections formed directly by the outer wall section **60***d*, **60***e*, as described.

The bass reflex channel **70** can also project—not shown—into the first housing chamber **20** over a certain depth. By way of example, this can be produced by virtue of a length of duct (not shown) projecting from the bass reflex opening **41** into the first housing chamber **20** in a manner known per se. In this case, the length of such a length of duct projecting into the first housing chamber **20** can be kept short, for example shorter than the length T1 of the bass reflex channel **70** in the second housing chamber **30**. That is to say that the bass reflex channel frequently provided within the loudspeaker housing chamber **20** in conventional embodiments can be displaced in the loudspeaker housing **100** partially or completely into the second housing chamber **30**, where it can be accommodated in space-saving fashion in a region that is acoustically shielded by the phase correction element **60** and hence represents a "dead" volume so to speak. In this case, as already described, outer wall sections **60***d*, **60***e* of the phase correction element **60** can be used to bound the bass reflex channel **70**, which additionally allows a saving on material to be attained.

Housing chambers and bass reflex channels each form acoustic resonators. The first housing chamber **20** with its internal volume forms a first resonator of the loudspeaker housing **10**. This first resonator interacts with the bass reflex resonator provided by the internal volume of the bass reflex channel. The combination of internal volume and geometry of the openings **41** determines the resonant frequency. The respective external volumes that immediately adjoin the front of the diaphragms **51** of the bass loudspeaker **50** form a second resonator. In this case, the effective volume and the effective opening area determine the resonant frequency. The effective volume and the effective opening area are significantly influenced by the geometry of the open second housing chamber **30** into which the bass loudspeaker radiates at the front. The external volume that the second resonator contains therefore likewise produces a resonance and prompts moderate low-pass filtering of the radiated sound. The low-pass filtering is accompanied by a slight sound level increase.

Without the phase correction element, the second resonator would be able to be used only in a frequency range below its fundamental resonance. Above the fundamental resonance, discrete modes that impair the sound are usually established. The flat phase correction element **60** arranged inside the second housing chamber **30** and hence inside the second resonator is used to decrease the mode acuity of the second resonator, so that the latter can also be used in a frequency range above its fundamental frequency. The physical (spatial) radiation response of the loudspeaker system **100** is influenced by the flat phase correction element **60** (unlike in the case of an acoustic lens) only little or not at all, for example.

As explained with reference to FIGS. **1** to **4**, at least one portion of the bass reflex resonator is formed in the second housing chamber **30** adjacent to the phase correction element **60** and is possibly bounded by the latter. This physical arrangement of the first resonator, the second resonator, the bass reflex resonator and the flat phase correction element **60** in the second resonator provides a space-saving and efficient geometry for the loudspeaker system **100**, as already explained. In this case, the effect that can be achieved by suitable production of the bass reflex channel inside the sec-

ond housing chamber **30** and optionally also inside the first housing chamber **20** is that more than 50%, particularly more than 80% and possibly 100%, of the air volume of the bass reflex resonator is situated in the second housing chamber **30**. In this case, as already explained, a wall region of the bass reflex resonator in the second housing chamber **30** can be formed by an outer wall section **60***d*, **60***e* of the phase correction element.

The loudspeaker system **100** explained by way of example with reference to FIGS. **1** to **4** can be varied in many different ways. By way of example, further bass reflex openings may be provided in the partition **40** or, by way of example, also in the side wall or back wall of the first housing chamber **20**. There may also be further loudspeakers, both bass loudspeakers and loudspeakers operating in other frequency ranges, accommodated in the partition **40** or in other walls.

FIGS. **5** to **7** show an exemplary loudspeaker system **200**, which may be identical to the loudspeaker system **100** apart from oblique installation of the bass loudspeaker **50** in the loudspeaker housing **10**. As can be seen from the sectional illustration in FIG. **6** (along the sectional line A-A in FIG. **5**), the partition **40** may be inclined with respect to the bottom of the loudspeaker housing **10**. The angle of inclination a between the bottom of the loudspeaker housing **10** and the partition **40** may be less than 80°, 70°, 60°, 50° or 40°, for example. In turn, the partition **40** divides the loudspeaker housing **10** into a first housing chamber **20** at the back of the bass loudspeaker **50** and an open, second housing chamber **30** at the front of the bass loudspeaker **50**. Side wall regions **60***a* and **60***b* of the phase correction element can extend up to the lateral housing walls in the second housing chamber **30** and, in the manner already described, contribute to forming or accommodating the bass reflex channel **70**. In the manner already described for the loudspeaker system **100**, said bass reflex channel may optionally also have a duct section that projects into the first housing chamber **20**, and it is also possible, on the basis of the description above, for the bass reflex channel **70** in the first housing chamber **10** to be formed by a separate length of duct that adjoins the opening **41** in the partition **40** in the x direction.

In other words, the arrangement of phase correction element **60**, opening **41** and partition **40**, and the form of the bass reflex channel **70** adjacent to the phase correction element **60**, may be produced in the same manner as has already been described for the loudspeaker system **100**. To avoid repetition, reference is made to the description above. However, the oblique installation of the partition **40** allows the use of a bass loudspeaker **50** having a greater diameter for a prescribed height H of the loudspeaker housing **10**, or else a decrease in the height H of the loudspeaker housing **10** for a prescribed diameter of the bass loudspeaker **50**.

In addition, FIG. **7** illustrates that, with oblique installation of the bass loudspeaker **50**, the central axis of the loudspeaker can run past the phase correction element **60** more closely or intersect it, for example at its boss **61** (this being possible even with the loudspeaker system **100** having a partition **40** running perpendicularly to the housing bottom, however). Hence, oblique installation of the bass loudspeaker **50** promotes the action of the phase correction element **60**, since the sound can be directed to the phase correction element **60** to a greater extent.

FIG. **8** illustrates that, in comparison with the loudspeaker system **100**, oblique installation allows a longer phase correction element **60** and/or a longer bass reflex channel **70** (i.e. a greater bass reflex resonator volume in the second housing chamber **30**) for the same housing dimensions.

FIGS. **9** to **11** schematically show an exemplary embodiment of a loudspeaker system **300** in various illustrations. The loudspeaker system **300** has a loudspeaker housing **10** that comprises a first housing chamber **20** and also a second housing chamber **30** and a third housing chamber **30'**. In addition, the loudspeaker system **300** has a further bass loudspeaker **50'** in addition to the bass loudspeaker **50** already described. The further bass loudspeaker **50'** may be identical to the bass loudspeaker **50**. The bass loudspeaker **50** radiates into the first housing chamber **20** at the back and into the second housing chamber **30** at the front. The further bass loudspeaker **50'** radiates into the third housing chamber **30'** at the front and into the common first housing chamber **20** at the back. However, provision may also be made for the first housing chamber **20** to be divided, by way of example, such that a separate resonator volume is provided for each of the two bass loudspeakers **50**, **50'**. In addition, provision may be made—not shown—for the second housing chamber **30** and the third housing chamber **30'** to form a common housing chamber, for example when the loudspeakers **50**, **50'** are positioned adjacently and—instead of in a manner directed away from one another as in FIGS. **9** to **11**—obliquely in a manner directed toward one another.

In the loudspeaker system **300**, a respective phase correction element **60** or **60'** is arranged at the front of the two bass loudspeakers **50**, **50'** in the manner already described. In addition, bass reflex openings **41** and **41'** in the respective partitions **40** and **40'** between the first housing chamber **20** and the second housing chamber **30** and between the first housing chamber **20** and the third housing chamber **30'** are provided. The bass reflex openings **41** and **41'** open into the second housing chamber **30** and the third housing chamber **30'**, respectively, in a region adjacent to the respective phase correction elements **60**, **60'**, see the description above.

As can be seen from the Figures, the two partitions **40**, **40'** may both be installed in the loudspeaker housing **10** at an inclination, as has been explained previously with reference to FIGS. **5** to **8**. The overall design of the loudspeaker system **300** may be symmetrical with respect to a center line M.

The loudspeaker system **300** may also have a further loudspeaker, e.g. a horn loudspeaker **80**. The horn loudspeaker **80** may be situated between the two bass loudspeakers **50**, **50'**. A horn **81** of the horn loudspeaker **80** can take up a large part of or practically the whole region between the two partitions **40**, **40'**, for example. As can be seen from FIG. **10**, the dimensions of the horn **81** in respect of the height thereof may be comparable to or else greater than the height H of the second and third housing chambers **30**, **30'**.

The effect that can be achieved by the arrangement with the respective oblique installation of the bass loudspeakers **50**, **50'**—as explained by way of example with reference to FIGS. **9** to **11**—is that the loudspeaker housing **10** has a comparatively small height overall and the distance between the centers of the sound radiation from the two bass loudspeakers **50**, **50'** is kept comparatively short. The formation of the bass reflex resonators (bass reflex channels **70**, **70'**) allows the volume of the respective bass reflex resonators to be largely or completely displaced, in the manner already described, into a space that is present on the outside or back of the respective phase correction element **60**, **60'**, which space, as a "dead" volume, would otherwise have practically no acoustic function.

The physical height of the loudspeaker housing **10** shown in FIGS. **9** to **11** may be greater than 40 cm, 60 cm, 80 cm, 100 cm or 120 cm, for example. The width and depth of the loudspeaker housing **10** can correspond to the dimensions already cited for the loudspeaker systems.

FIG. **12** shows a semitransparent perspective view of a partial region of the loudspeaker system **300**. As can be seen in FIG. **12**, a sound exit opening of the bass reflex resonator or of the bass reflex channel **70** may be arranged between a contour line **62** of the phase correction element **60** and a side wall **30***a* and/or a bottom wall **30***b* of the second housing chamber **30**. In the exemplary embodiment shown in FIG. **12**, the contour line **62** of the phase correction element **60** extends from the side wall **30***a* up to the bottom wall **30***b*, i.e. the outside or back of the phase correction element **60** forms the bass reflex channel **70** together with the wall regions **30***a* and **30***b*. As already explained, however, provision may also be made for the bass reflex channels **70** each to be formed—in a manner that is not shown—by a separate length of duct that extends from the opening **41** in the partition between the outside of the phase correction element **60** and the wall regions **30***a*, **30***b*. In this case, the contour line **62** of the phase correction element may have a curvature that matches the curvature of the length of duct (not shown).

The form shown in FIG. **12** for the phase correction element **60** can be used in all the exemplary embodiments and it can be interpreted—by way of example—as being to scale. In general, however, it is to be noted that phase correction elements **60** have a high degree of form variability, and therefore shapes other than the forms shown in the present specification are also possible.

What is claimed is:

**1**. A loudspeaker system, comprising:
- a loudspeaker housing having at least a first housing chamber and a second housing chamber,
- a bass loudspeaker that is mounted on a partition between the first housing chamber and the second housing chamber, wherein the first housing chamber is present at a back of the bass loudspeaker and the second housing chamber is present at a front of the bass loudspeaker,
- at least one bass reflex opening in the partition, and
- a phase correction element that is arranged at the front of the bass loudspeaker in the second housing chamber, wherein:
  - the phase correction element has a form of a wing, the wing comprising an inner wall section and an outer wall section opposite the inner wall section,
  - the bass loudspeaker radiates sound onto the inner wall section, and
  - the bass reflex opening opens into the second housing chamber and is arranged in a region to radiate sound onto the outer wall section.

**2**. The loudspeaker system as claimed in claim **1**, wherein the phase correction element extends radially outward from a central region of the bass loudspeaker on both sides with reference to a direction of radiation.

**3**. The loudspeaker system as claimed in claim **1**, wherein the bass reflex opening in the partition is formed in a region of a corner of the first housing chamber.

**4**. The loudspeaker system as claimed in claim **1**, wherein the outer wall section of the wing of the phase correction element forms a wall region of a bass reflex channel containing the bass reflex opening.

**5**. The loudspeaker system as claimed in claim **1**, wherein at least one wall section of the second housing chamber forms a wall region of a bass reflex channel containing the bass reflex opening.

**6**. The loudspeaker system as claimed in claim **1**, wherein a bass reflex channel containing the bass reflex opening extends over less than 50% of its length in the first housing chamber.

**7**. The loudspeaker system as claimed in claim **1**, wherein a bass reflex channel containing the bass reflex opening has a sound exit opening that is situated between at least one housing wall of the second housing chamber and a contour line of the phase correction element.

**8**. The loudspeaker system as claimed in claim **7**, wherein the sound exit opening is situated in a corner region of the second housing chamber.

**9**. The loudspeaker system as claimed in claim **1**, wherein the partition runs at an inclination with respect to a back housing wall.

**10**. The loudspeaker system as claimed in claim **9**, wherein a bass reflex channel containing the bass reflex opening extends at least from a rear end of the partition to a front end of the partition.

**11**. The loudspeaker system as claimed in claim **1**, further comprising:
- a further bass loudspeaker that is mounted on a further partition between the first housing chamber and the second housing chamber or a third housing chamber of the loudspeaker housing, wherein the first housing chamber is present at a back of the further bass loudspeaker and the second housing chamber or the third housing chamber is present at a front of the further bass loudspeaker,
- at least one further bass reflex opening in the further partition, and
- a further phase correction element that is arranged at the front of the further bass loudspeaker in the second housing chamber or the third housing chamber, wherein:
  - the further bass reflex opening opens into the second housing chamber or third housing chamber and is arranged in a region adjacent to the further phase correction element.

**12**. The loudspeaker system as claimed in claim **11**, wherein the partition and the further partition each run at an inclination with respect to a back housing wall.

**13**. The loudspeaker system as claimed in claim **11**, further having:
- a horn loudspeaker that is arranged between the bass loudspeaker and the further bass loudspeaker.

**14**. A loudspeaker system, comprising:
- a bass loudspeaker,
- a first housing chamber into which the bass loudspeaker radiates at a back and that forms a first resonator,
- a second housing chamber into which the bass loudspeaker radiates at a front and that forms a second resonator,
- a bass reflex channel that interacts with the first resonator, and
- a phase correction element that is arranged at a front of the bass loudspeaker and accommodated in the second housing chamber for decreasing a mode acuity of the second resonator, wherein:
  - the phase correction element has a form of a wing, the wing comprising an inner wall section and an outer wall section opposite the inner wall section,
  - the bass loudspeaker radiates sound onto the inner wall section, and
  - at least one portion of the bass reflex channel is formed in the second housing chamber and runs adjacent to the outer wall section.

**15**. The loudspeaker system as claimed in claim **14**, wherein a sound exit opening of the bass reflex channel is arranged between a contour line of the phase correction element and a wall of the second housing chamber.

**16**. The loudspeaker system as claimed in claim **14**, wherein more than 50% of an air volume of the bass reflex channel is situated in the second housing chamber.

17. The loudspeaker system as claimed in claim 14, wherein a wall region of the bass reflex channel is formed by the outer wall section of the wing of the phase correction element.

18. A loudspeaker system, comprising:

a loudspeaker housing that has at least a first housing chamber and a second housing chamber,

a bass loudspeaker that is mounted on a partition between the first housing chamber and the second housing chamber, wherein the first housing chamber is present at a back of the bass loudspeaker and the second housing chamber is present at a front of the bass loudspeaker,

at least one bass reflex channel that is in connection with the first housing chamber, and

a phase correction element that is arranged at the front of the bass loudspeaker in the second housing chamber, wherein:

the phase correction element has a form of a wing, the wing comprising an inner wall section and an outer wall section opposite the inner wall section,

the bass loudspeaker radiates sound onto the inner wall section, and

at least one subsection of the bass reflex channel extends in the second housing chamber and runs in a region adjacent to the outer wall section.

19. A loudspeaker system, comprising:

a loudspeaker housing having at least a first housing chamber and a second housing chamber,

a bass loudspeaker that is mounted on a partition between the first housing chamber and the second housing chamber, wherein the first housing chamber is present at a back of the bass loudspeaker and the second housing chamber is present at a front of the bass loudspeaker,

at least one bass reflex opening in the partition,

a phase correction element that is arranged at the front of the bass loudspeaker in the second housing chamber, wherein:

the bass reflex opening opens into the second housing chamber and is arranged in a region adjacent to the phase correction element,

a further bass loudspeaker that is mounted on a further partition between the first housing chamber and the second housing chamber or a third housing chamber of the loudspeaker housing, wherein the first housing chamber is present at a back of the further bass loudspeaker and the second housing chamber or the third housing chamber is present at a front of the further bass loudspeaker,

a horn loudspeaker that is arranged between the bass loudspeaker and the further bass loudspeaker,

at least one further bass reflex opening in the further partition, and

a further phase correction element that is arranged at the front of the further bass loudspeaker in the second housing chamber or the third housing chamber, wherein:

the further bass reflex opening opens into the second housing chamber or third housing chamber and is arranged in a region adjacent to the further phase correction element.

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